Riverside Nursery is protected on the north both by the diversion of the cold air stream and by the city of Phoenix itself with its warming influence. Protection on the south is afforded by the broad bed of the Salt River, which diverts cold air draining from hills on the south to the west. Riverside Nursery is three or four degrees warmer than might be expected if elevation, in relation to the other stations considered, were the determining factor.

The inversion layer appears to have its base some 40 feet above the lowest elevation shown in the section, at least on the north side of the valley. In a general way, this layer may be thought of as made up of superimposed, approximately horizontal air strata in which the temperature rises with the increase in elevation. The positions of the strata within the layer are subject to constant change from the moment the condition of inversion begins, usually late in the afternoon, until the condition is ended by the rising temperatures of the following morning. We are more particularly interested in conditions within the layer at the time of minimum temperature as that is the time at which almost invariably

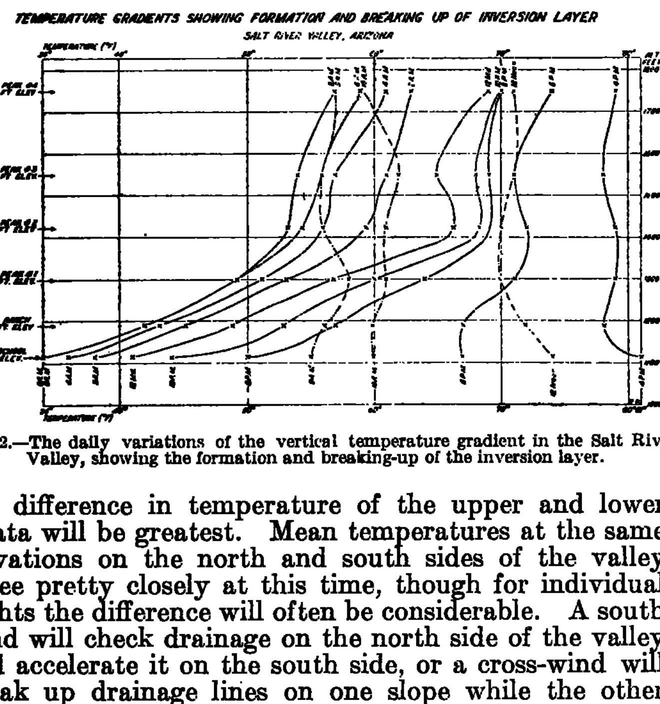


FIG. 2.—The daily variations of the vertical temperature gradient in the Salt River Valley, showing the formation and breaking-up of the inversion layer.

the difference in temperature of the upper and lower strata will be greatest. Mean temperatures at the same elevations on the north and south sides of the valley agree pretty closely at this time, though for individual nights the difference will often be considerable. A south wind will check drainage on the north side of the valley and accelerate it on the south side, or a cross-wind will break up drainage lines on one slope while the other may be calm. Even where a single slope is considered there is a constant variation in the inversion layer from night to night. The section of the layer in which the rate of vertical change is greatest shifts up and down, the depth of the layer almost certainly changes. No two nights show identical records.

It is in relation to study of inversion on a single slope comparatively free from complicating topographic features that most of the graphs and thermograph tracings were made up. The Indian School, being at the foot of the slope drained, is taken as a base and five other stations on an unbroken slope rising 635 feet above it offer excellent opportunity for a study of temperatures within the layer. The thermograph tracings show the development of the inversion condition, as does one set of graphs, from the time of maximum temperature on the preceding day to the time of minimum and the rise of temperature the following morning. Other graphs show simply the temperature gradient within the layer at the time of minimum temperature and represent the mean of a number of days.

Relative humidity appears to be a factor in determining the contrasts of temperature within the inversion layer. Where a number of consecutive mornings are considered, that one with the highest humidity the preceding evening almost invariably shows the smallest contrasts of temperature in the inversion layer. The graphs show the decrease in temperature contrasts through November, December, January, and February, while in March there was a sharp increase. Records show that the mean 6 p. m. relative humidity increased from November through February and dropped sharply in March. It is also suggested that the cooling of the earth itself, the gradual loss of accumulated heat with the advance of winter, may partly explain the progressive decreases in temperature contrast shown by the gradients of December, January, and February, and the increase with the higher day temperatures of March. In other words, there is less heat radiated from the earth itself to influence the temperature of the upper strata of the inversion layer.

551.525

DAILY TEMPERATURE VARIATIONS AT THE SURFACE OF THE GROUND IN HOT ARID CLIMATES.

By PAUL RANGE.

[Abstracted from *Meteorologische Zeitschrift*, Mar.–Apr., 1920, pp. 102-104.]

It is of value in studying the effects of erosion to observe the variations of temperature of the upper layers of the ground, because it is certain that such variations play considerable part in the disintegration of the rocks, especially where they are composed of minerals having different coefficients of expansion. Such observations were made for two and one-half years at Kuibis, in German Southwest Africa. Kuibis is 1308 meters above sea level, and lies 175 km. inland from the Atlantic Ocean. Observations were made with a mercurial thermometer possessing a black bulb in an evacuated chamber; an Arago-Davy Actinometer, which is a similarly constructed instrument with an unblackened bulb; a mercurial maximum thermometer and an alcohol minimum thermometer. Observations were made in the air and on the surface of the ground.

The black-bulb thermometer readings averaged 8° C. higher on the ground then in the air for the year, probably owing to the nature of the soil. The following table shows the air and ground temperatures for the year:

	Minimum.	Maximum.	Mean.	Range.
	°C.	°C.	°C.	°C.
Air	18.3	30.8	24.5	12.5
Ground	14.9	47.8	31.2	32.9
Difference	−3.4	17.0	6.7	20.4

When compared with the table given by Hann[1] for the Indian station, Jaipur, it is found that the extremes at Kuibis are greater than those of the Indian station, partly because of its greater elevation and partly because of the great amount of sunshine. The minimum occurs about sunrise—in winter about 7 a. m. and in summer about 5 a. m. The maximum occurs about noon. The range of temperature between sunrise and noon in summer is about 60° C. and in winter is about 50° C. These

[1] *Meteorologie*, p. 48.

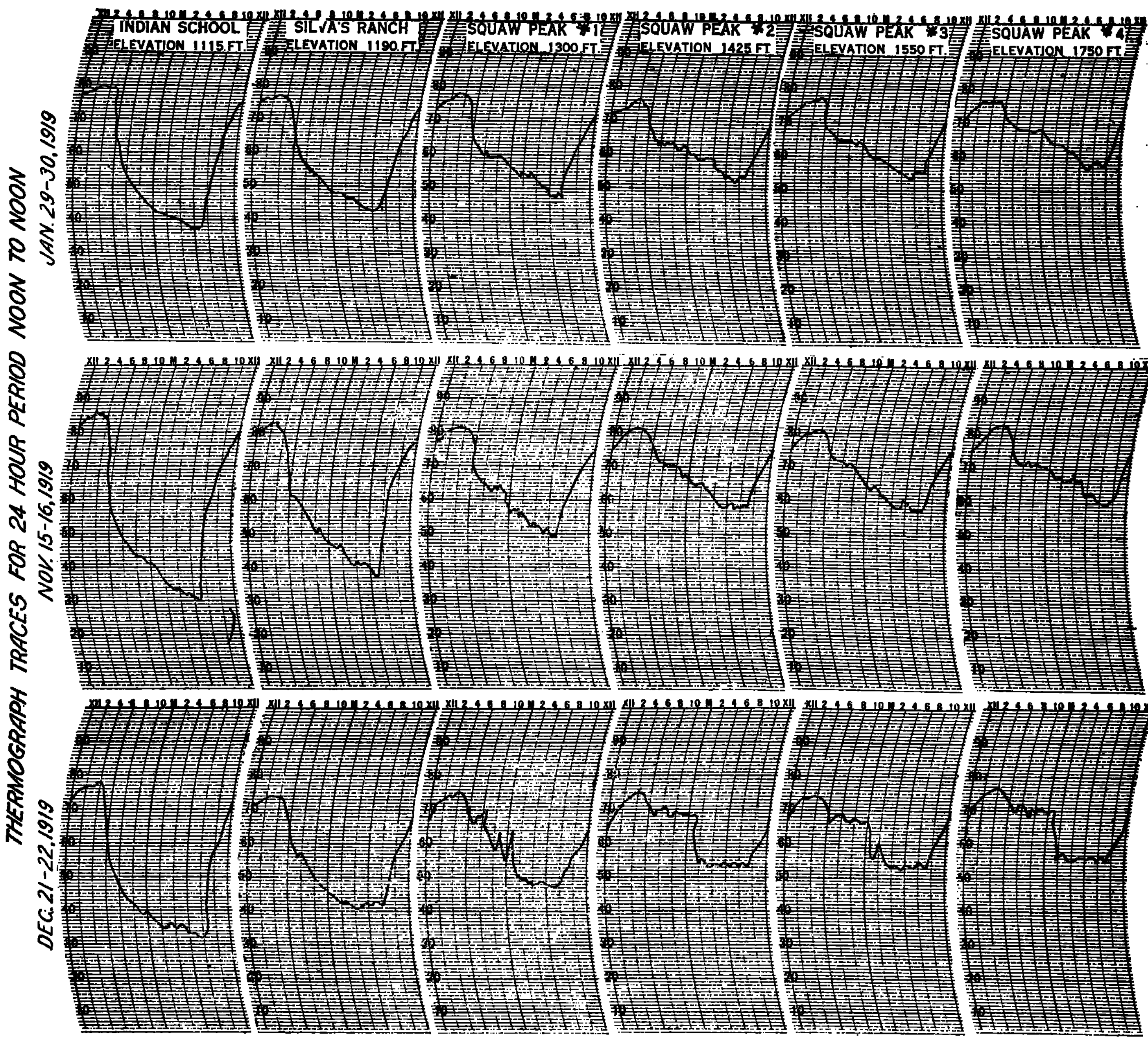


FIG. 3.—Thermograph traces at various elevations in the Salt River Valley, Ariz.

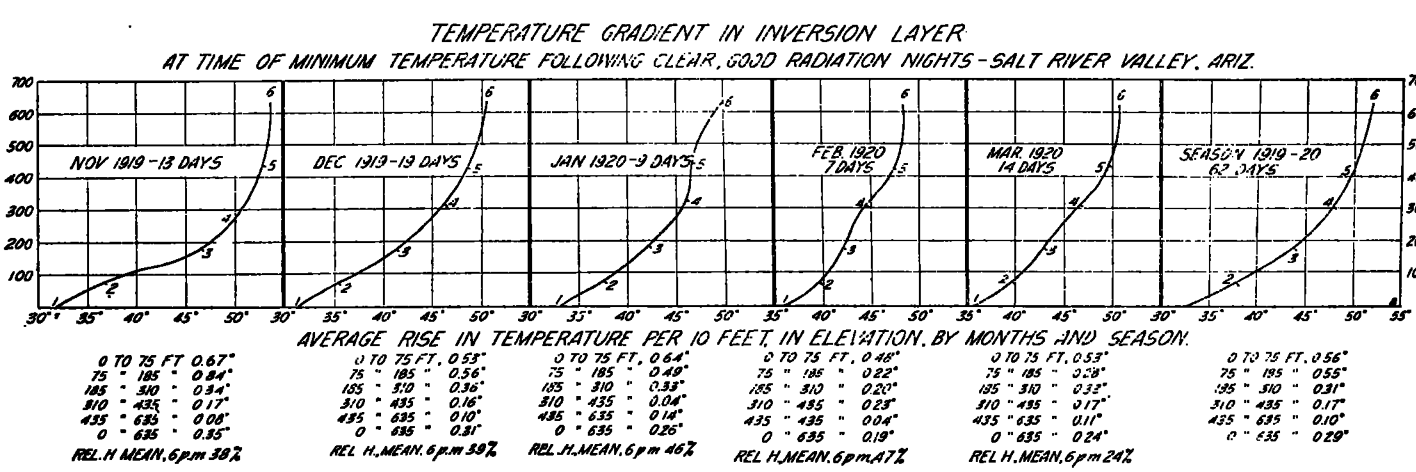


FIG. 4.—Mean temperature gradients within the inversion layer at the time of minimum temperature in the Salt River Valley.

enormous ranges repeat themselves day after day, owing to the persistent bright sunshine. The sunshine recorder reveals the fact that there are about 4,000 hours of sunshine per year, which is about 92 per cent of the possible sunshine. Only seldom do short, heavy showers occur which effect a cooling of the stony surface. These showers, while brief, are of great importance, both from their chemical action upon the rocks and from their ability to transport, in a very short time, great masses of accumulated deposit.—*C. L. M.*

551.524

DAILY COURSE OF TEMPERATURE IN THE LOWER AIR.[1]

By WILHELM SCHMIDT.

"All observations, both those in the free air and those on towers near the ground, agree fully with the theory that two reasons for the occurrence of the daily temperature course are:

"1. Radiation on the earth's surface, which through conduction of heat from sunlight sends up a rapidly decreasing temperature wave into the air, which on the average is noticeable up to about 500 to 1,000 meters, and

"2. Direct radiation conversion in the air, which throughout the whole atmosphere produces a temperature variation of essentially the same phase.

"* * * The same causes, although different in characteristics of strength, occur naturally also in the annual course. One could evaluate even these, but he has no more the pure simple characteristics, since the conditions aloft do not locally depend on the underlying conditions, but through convection are changed from afar and made uniform." [2]

DISCUSSION.[3]

"At the meeting, on January 24, Mr. L. F. Richardson discussed papers by W. Schmidt on (1) exchange of mass in irregular currents in the free air and its consequences, and (2) the effects of the exchange of air on climate and the diurnal variation of temperature in the upper air.

"The central idea of Schmidt's papers is that the same laws will govern the exchange of various properties between layers of the atmosphere. Heat, water vapor, dust, and carbonic acid can all be transported, and in each case the result of mixing two samples of air from different regions is that the concentration of the property in question is averaged. The rate at which this averaging takes place is measured by a certain coefficient A, the 'Austausch,' which is defined by the author in a somewhat complicated way. In the kinetic theory of a gas regarded as an aggregate of molecules the 'Austausch' would be proportional to the frequency with which molecules cross unit area on a horizontal plane and to their mean free path. In the theory of eddies there is nothing which corresponds exactly with the mean free path, and the specification of the 'Austausch' leads to difficulties. The 'Austausch' is closely related to the coefficient ϵ of Mr. Richardson's own papers on this subject, and it is equal to $k\rho$, where k is the coefficient denoted by that symbol in G. I. Taylor's work and ρ is the density.

"As an example of Schmidt's results we may quote his estimates of the rate at which water passes upward in the form of vapor past the levels of 1,000 m. and 3,000 m. For Lindenberg he finds that in the course of the average day 0.063 gram of water is carried upward across each square centimeter at 1,000 m. and similarly 0.039 at 3,000 m. These values are arrived at by estimating the 'Austausch' from considerations of wind strength, and applying the result to find the movement of the water vapor.

"The great range in the possible values of the 'Austausch,' which is practically a measure of turbulence, is remarkable. Using wind observations, Schmidt finds that the average 'Austausch' at 200 meters is nearly 30 times that at 1 meter."

[1] Uber den täglichen Temperaturgang in den unteren Luftschichten. *Meteorologische Zeitschrift*, 1920, H. 3/4. Bd. 37:49-59. 2 figs.

[2] Extracts from author's summary.

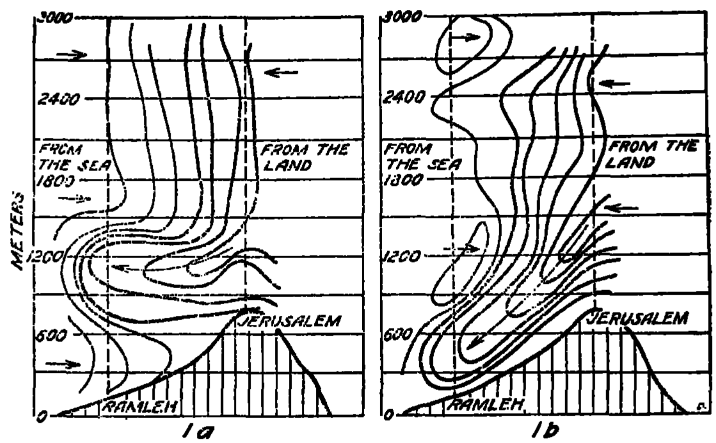
[3] Reprinted from the *Meteorological Magazine*, London, Feb., 1921, pp. 7-8.

THE SIROCCOS OF THE SINAI DESERT.

551.55 (569.4) By W. SPÄTH.

[Abstracted from *Meteorologische Zeitschrift*, Jan.-Feb., 1920, pp. 26-29.]

This article on the siroccos of Palestine does not add much to the material presented in earlier paper by Walter Georgii in *Meteorologische Zeitschrift*.[1] Of chief



FIGS. 1a-1b.—Wind conditions above Jerusalem and Ramleh, on March 29 and 30, 1917, respectively, showing the advance of the tongue of hot, dry air over the mountains and down the slope toward the sea.

interest are the diagrams. The author has shown the advance of the wind over the mountains of Judea by means of vertical sections normal to the wind direction. The hot wind is from the southeast. This enabled the synchronous conditions at Jerusalem and Ramleh to be portrayed. The first of two diagrams showing the sirocco of March 29–30, 1917, shows an advancing tongue of southeast wind passing over the range and extending in a northwesterly direction over Jerusalem. This wind is being opposed by a wind from the sea. The second figure shows the tongue of warm, dry air, descending along the slope and consequently heating dynamically. The cool on-shore wind is still contesting the advance of the southeast wind aloft. (Figs. 1a–1b.)

Another interesting diagram (Fig. 2a), is that showing the conditions at Ramleh from March 21 to 30, 1917. The abscissae are days, the ordinates are altitudes, and the curves are lines of equal wind intensity. The sirocco wind is shown in heavy lines and the sea wind is in light lines. The last diagram (Fig. 2b), also show-

[1] Sirocco observations in the southwestern part of Palestine. 36:193-197, 1919. Abstract in Mo. WEATHER REV. Jan. 1920, p. 40.